

**STATE OF CALIFORNIA**

**Department of Transportation**

**<sup>1</sup>Specification #8010-20B**

(revised Jan., 2000)

**For**

**Paint, Waterborne Traffic Line,  
White, Yellow and Black**

- 1.0        **SCOPE**     This Specification is intended to cover ready-mixed one component waterborne traffic line paint to be applied to either asphaltic or portland cement concrete pavements.
- 2.0        **SPECIFICATIONS AND STANDARDS**     The following Specifications, Test Methods, and Standards in effect on the opening date of the Invitation for Bid form a part of this Specification where referenced.

- ASTM D65, ASTM D75, ASTM D93, ASTM D476, ASTM D522, ASTM D562, ASTM D711, ASTM D713, ASTM D1210, ASTM D1475, ASTM D1640, ASTM D1729, ASTM D1849, ASTM D2243, ASTM D2369, ASTM D2486, ASTM D3186, ASTM D3335, ASTM D3718, ASTM D3723, ASTM D3960, ASTM D4563, ASTM D5380, ASTM E70, and ASTM G53.
- Federal Specification 595b, Color #33538 and #37038.
- Code of Federal Regulations, Title 49.
- California Department of Transportation, Test Method No. 660.
- California Department of Transportation, Standard Specifications, July, 1999.

3.0        **REQUIREMENTS**

- 3.1        **General:**     This Specification is intended to specify paint that will meet service requirements for highway construction and maintenance.

3.1.1     **Pre-Bid Qualifications**

The Department of Transportation maintains a Qualified Products List (QPL) for Waterborne Traffic Line Paint. Only those brands and product numbers listed on the QPL will be accepted for State of California purchase and use. Section 7.2 contains the requirements for qualification of traffic paint products as well as the current qualified products list. The qualification process may require up to 1 year. Vendors wishing to have their new products

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<sup>1</sup> Note: This Specification cancels and supersedes; #8010-20A (February, 1997), #8010-20 (March, 1996), #8010-03QPL (October, 1994), #8010-21C-30 (March, 1992), and #8010-91D-30A (April, 1989).

qualified for future bids must contact the Transportation Laboratory in writing at the address listed in Section 7.2.

### 3.2 Composition:

3.2.1 The composition of the paint shall be determined by the manufacturer. However, the paint shall not be manufactured using lead or chromium pigments. It will be the manufacturer's responsibility to produce a pigmented water borne paint containing the necessary co-solvents, dispersants, wetting agents, preservatives and all other additives, so that the paint will retain its viscosity, stability and all other properties as specified herein. No glass beads or sand shall be permitted in the paint formulation.

### 3.3 Characteristics of the Finished Paint:

#### 3.3.1 Condition in the Container

The paint, as received, shall show no evidence of biological growth, corrosion of the container, livering or hard settling. The paint shall be returned to a smooth and homogeneous consistency, which is exempt of gel structures, persistent foam or air bubbles, by hand mixing.

		<u>White</u>	<u>Yellow</u>	<u>Black</u>
3.3.2	Consistency, K.U. at 25 $\pm$ 1°C ASTM D562	75-90	75-90	75-90
3.3.3	Fineness of Dispersion, Hegman, minimum, ASTM D1210	3.0	3.0	3.0
3.3.4	Dry to No Pick-Up Time, without beads, minutes, maximum, ASTM D711	10	10	10
3.3.5	Dry through, minutes, maximum	20	20	20

This test may be performed on the same draw down sample as in section 3.3.4. The test is the same as outlined in ASTM D1640 except that the lightest thumb pressure possible should be used. The thumb is rotated through an angle of 90 degrees while lightly in contact with the film. The drying time at which this rotation does not break the film is recorded.

		<u>White</u>	<u>Yellow</u>	<u>Black</u>
3.3.6	Dry Through, 90% Relative Humidity, minutes, maximum	180	180	-

Draw down the paint on a glass panel to a wet film thickness of 330 $\mu$ m. Immediately place the panel in a humidity chamber maintained at 23 $\pm$ 2°C and 90 $\pm$ 5% relative humidity. Test in accordance with ASTM D1640 except that the pressure exerted shall be the minimum needed

to maintain contact between the thumb and the paint film. Check the film for a dry through condition at 15 minute intervals. The thumb is rotated through an angle of 90 degrees while lightly in contact with the film. The drying time at which this rotation does not break the film is recorded. Quickly return the glass panel to the humidity chamber after each check.

3.3.7	Volatile Organic Compounds (VOC), grams per liter of paint, excluding water, maximum.	<u>White</u> 150	<u>Yellow</u> 150	<u>Black</u> 150
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Use ASTM D3960 or other approved method in effect at the time of paint manufacture to determine the VOC level and water content of the paint.

3.3.8	Flashpoint, ASTM D93 Method A, minimum, °C	<u>White</u> 38	<u>Yellow</u> 38	<u>Black</u> 38
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3.3.9	Flexibility, ASTM D522 Method B	<u>White</u> Pass	<u>Yellow</u> Pass	<u>Black</u> Pass
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Use 100x150 mm tin-plated steel panels 250µm thick. Prepare the panel by lightly buffing one side with Grade 0 (medium-fine) steel wool, followed by cleaning with toluene and drying. Draw down the paint on the buffed side of the panel to a wet film thickness of 130µm. Air dry the panel for 24 hours at <sup>2</sup>standard conditions, then bake for 5 hours at 105±2°C and finally condition the panel for 30 minutes at standard conditions. Bend 180° over a 13 mm mandrel and examine under a magnification of 10 diameters. The paint film shall not crack, chip or flake when the panel is bent around the mandrel.

3.3.10	Appearance	<u>White</u> Pass	<u>Yellow</u> Pass	<u>Black</u> Pass
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Draw down a 330µm thick wet film of the paint on a glass plate and allow to dry for 24 hours at standard conditions. The paint shall produce a film which is smooth, uniform, and free from; grit, undispersed particles, craters, pinholes and cracking.

3.3.11	Dry Opacity, minimum	<u>White</u> 0.90	<u>Yellow</u> 0.85	<u>Black</u> 1.0
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On a black-white Leneta chart, Form 2C-Opacity, draw down a 130µm thick wet film of paint covering both the black and white portions of the chart. Measure the wet film thickness with an appropriate gauge. Dry for 24 hours at standard conditions. Use a Photovolt Reflection Meter, Model 670 or equivalent, with Model 610 T Search Unit provided with Tristimulus

<sup>2</sup> Standard conditions are defined here as: 23±2°C and 50±5% relative humidity.

filters; green, blue and amber. Calibrate according to the manufacturer's instructions and measure the reflectance over the white and black portions with the green filter. Dry Opacity is calculated as:

$$\frac{\text{Reflectance over black}}{\text{Reflectance over white}} = \text{Dry Opacity}$$

		<u>White</u>	<u>Yellow</u>	<u>Black</u>
3.3.12	Yellowness Index, maximum	8	-	-

Draw down a 330µm thick wet film on two 75x150 mm chromate treated aluminum panels (i.e.: Q Panel Co., type AL). Dry for 24 hours at standard conditions. Save one panel for the Accelerated Weathering test (section 3.3.16). Using a Reflection Meter (see section 3.3.11), measure the reflectance of the white paint film using the green, blue and amber tristimulus filters. Follow the manufacturer's instructions to recalibrate the Reflection Meter as the filters are changed. Calculate the Yellowness Index as follows:

$$\text{Yellowness Index} = \frac{\text{Amber} - \text{Blue}}{\text{Green}} \times 100$$

		<u>White</u>	<u>Yellow</u>	<u>Black</u>
3.3.13	Daylight Luminous Reflectance	86 min.	50-60	-

With the same draw down as in section 3.3.12 above, measure the reflectance of the white and yellow paint films using the Reflection Meter and the green tristimulus filter.

#### 3.3.14 Yellow Color

Draw down the yellow paint on two chromate treated aluminum panels as described in section 3.3.12. One panel should be used for the Accelerated Weathering test (section 3.3.16). Retain the other yellow panel as a control and for the Reflectance test (section 3.3.13). The yellow color shall match Federal Standard 595b, color #33538 and shall lie within the chromaticity coordinate limits as defined below when tested according to California Test Method No. 660 and plotted on a C.I.E. (1931) Chromaticity Diagram. The yellow color shall lie within these chromaticity coordinate limits both before and after the Accelerated Weathering test. A graph for plotting the chromaticity coordinates is available from the Transportation Laboratory.

Measurement conditions: 2°/Illuminant "C"  
Hue: 580 to 583.5 nm  
Minimum color saturation: x=0.7000-0.5000y  
Brightness: Y=50 to 60

#### 3.3.15 Black Color

Draw down the black paint on a chromate treated aluminum panel as described in section 3.3.12. After drying for 24 hours at standard conditions the color shall closely match Federal Standard 595b, color #37038.

### 3.3.16 Accelerated Weathering Test

Ultraviolet Light and Condensate Exposure, ASTM G53. 300 hours total.

Prepare samples of the white and yellow paints as described in section 3.3.12. Alternately expose the samples to four hours of UV exposure at 60°C, followed by four hours condensate exposure at 40°C. Type FS-40 (UV-B) bulbs are used at an irradiance level of 0.47 watts per square meter at 310 nm., as measured at the sample surface during the UV cycle. After 300 hours total exposure the paint samples shall meet the requirements below. Retain these samples for the Scrub Resistance test (see section 3.3.17).

White - Yellowness Index, maximum, 12 (see section 3.3.12)

Yellow - Must pass Yellow Color test (see section 3.3.14)

	<u>White</u>	<u>Yellow</u>	<u>Black</u>
3.3.17 Scrub Resistance, cycles, minimum	500	500	-

Follow the procedure in ASTM D2486 modified to use the exposed 75x150 mm panels from the Accelerated Weathering test (section 3.3.16). Tape the aluminum sample panel to the scrub machine with its 75 mm length parallel to the axis of scrubbing and laying in the path of the oscillating scrub brush. No shim should be used. The paint shall not wear through on any part of the paint film in less than 500 cycles.

	<u>White</u>	<u>Yellow</u>	<u>Black</u>
3.3.18 Roadway Service Durability Rating, minimum ASTM D713, after 180 days exposure	6	6	-

Test stripes shall be applied transversely across the pavement in accordance with ASTM D713. Paints shall be applied and tested on both portland cement concrete and asphalt concrete pavements.

Dry paint film thickness of the test stripes shall be between 130 and 200µm as determined from test panels taken during application. Current State Specification glass beads (moisture-proof type) shall be applied immediately after the paint and during the same striping operation. The paint film shall accept the glass beads so that the spheres are embedded into the film to a depth of 60% of their diameter. Test stripes will be observed for a period of 180 days from the date of application.

After 180 days of service, the durability of the test stripes will be rated from 0 to 10 in accordance with ASTM D713. Only those test stripes with a rating of 6 or better will be accepted. The test stripes shall exhibit adequate retention of glass beads. This will be determined by close-up examination of the test stripes.

This Roadway Service Durability Rating test may be waived at the option of the Engineer or evaluated for a period of less than 180 days.

3.3.19	Lead, mg/kg in dried paint, maximum, ASTM D3335	<u>White</u> 100	<u>Yellow</u> 100	<u>Black</u> 100
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3.3.20	Chromium, mg/kg in dried paint, maximum, ASTM D3718	<u>White</u> 50	<u>Yellow</u> 50	<u>Black</u> 50
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3.3.21	Thick Application Cracking Resistance	<u>White</u> Pass	<u>Yellow</u> Pass	<u>Black</u> Pass
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On a black-white Leneta chart, Form 2C-Opacity, draw down a stripe of the paint 75 mm wide and at least 150 mm long and having a  $1530 \pm 130 \mu\text{m}$  wet film thickness. Allow the paint to dry for 48 hrs. at standard conditions on a horizontal surface. After 48 hrs. the paint film shall not contain any cracks.

3.3.22	Accelerated Package Stability	<u>White</u> Pass	<u>Yellow</u> Pass	<u>Black</u> Pass
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Fill a clean 500 mL (1 pint) resin-lined friction-top paint can with a well-stirred sample. Immediately close the can tightly. Store this can in an oven at a temperature of 52°C for 14 days. After 14 days remove the can from the oven and allow the can to cool overnight. Determine the Consistency of the paint as in section 3.3.2, except allow hand stirring of the sample for 5 minutes to ensure uniform redistribution of any settlement before testing. The Consistency of the paint shall not change more than 5 K.U. after this heated storage period. Draw down a 330 $\mu\text{m}$  thick wet film of this sample on a glass plate and examine for Appearance as in 3.3.10.

#### 3.4 Allowable Variations:

The following properties will be measured at the time of qualification and again during the delivery of production lots. The composition and properties of the paint must remain within the allowable variations as indicated. If any property falls outside the variances, the batch will be rejected and replaced at the manufacturer's expense.

3.4.1	Density, g/mL, at 25°C, ASTM D1475, allowable variation from qualifying sample	<u>White</u> $\pm 0.04$	<u>Yellow</u> $\pm 0.04$	<u>Black</u> $\pm 0.04$
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3.4.2	Pigment, Weight %, ASTM D3723, allowable variation from qualifying sample	<u>White</u> $\pm 2.0$	<u>Yellow</u> $\pm 2.0$	<u>Black</u> $\pm 2.0$
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3.4.3	Nonvolatile Content, Weight %, ASTM D2369 allowable variation from qualifying sample	<u>White</u> ±2.0	<u>Yellow</u> ±2.0	<u>Black</u> ±2.0
3.4.4	Infrared Spectra of Nonvolatile Vehicle ASTM D3168 allowable variation from qualifying sample	<u>White</u> None	<u>Yellow</u> None	<u>Black</u> None
3.4.5	X-Ray Diffraction Scan of Pigments ASTM D5380 allowable variation from qualifying sample	<u>White</u> None	<u>Yellow</u> None	<u>Black</u> None
3.4.6	pH, ASTM E70 allowable variation from qualifying sample	<u>White</u> ±1.0	<u>Yellow</u> ±1.0	<u>Black</u> ±1.0

### 3.5 Workmanship:

- 3.5.1 The paint shall be free from foreign materials such as; dirt, sand, fibers, or other materials capable of clogging; screens, valves, pumps, or other equipment used in paint stripping apparatus.
- 3.5.2 The paint pigment shall be well ground and properly dispersed in the vehicle. The pigment shall not cake or thicken in the container and shall not become granular or curdled. Any settlement of the pigment in the paint shall result in a thoroughly wetted soft mass that permits the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with a minimum of resistance to the sidewise manual motion of the paddle across the bottom of the container. This stirring shall return the paint to a smooth uniform product of the proper consistency. If the paint cannot be easily redispersed, due to excessive pigment settlement or any other cause, then the paint shall be considered unfit for use.
- 3.5.3 The paint shall retain all specified properties under normal storage conditions for 8 months after acceptance and delivery. The vendor shall be responsible for all costs and transportation charges incurred in replacing paint that is unfit for use. The characteristics of any replacement paint, as specified in section 3.3, shall remain satisfactory for 8 months from the date of acceptance and delivery.
- 3.5.4 The paint shall comply with all air pollution control rules and regulations within the State of California in effect at the time the paint is manufactured.

#### 4.0 QUALITY ASSURANCE PROVISIONS

4.1 Inspection and Testing: Each batch of waterborne traffic paint intended for use by the State of California must be tested by a qualified testing laboratory. See section 7.2 for a description of what constitutes a qualified testing laboratory. A batch shall be that amount of paint that was manufactured and packaged in a single operation. A certified copy of the test report along with a representative 1L (one-quart) sample of each batch of paint shall be sent to the Transportation Laboratory at the address below. The following information shall be included in the test report: Dry to No Pick-Up time, Dry Opacity, Yellowness Index, Reflectance, Consistency, Non-Volatile Weight Percent, Pigment Weight Percent and Density.

The first three production batches of each color, formulated by a manufacturer producing paint for this specification, shall be tested and approved by the Transportation Laboratory prior to shipment. If the manufacturer's certified test results do not conform to specified requirements or correlate with results obtained by the Transportation Laboratory, to the satisfaction of the Engineer, the batch of paint will be rejected. One resample will be allowed if a batch fails initial laboratory tests.

Once the first three batches of each color are accepted, subsequent batches shall be treated as follows;

The manufacturer shall send to the Transportation Laboratory a representative 1L (one-quart) sample of each batch of paint along with the certified test results noted above within 3 days of the product being shipped. The Transportation Laboratory may elect to perform any or all of the specified tests on this sample. Material not meeting specified requirements, as determined by the Transportation Laboratory, shall be removed and replaced by the manufacturer at his expense, including all costs for handling, retesting and shipping. The Engineer may elect to resample any batch of paint at any time to ensure conformance with these specifications. One resample will be allowed if a batch fails initial laboratory tests.

Whenever a shipment of waterborne traffic paint is made for any Department of Transportation contract, a list of each shipping location including; name and phone number of contact person, colors, batch numbers and quantity of each paint product delivered - shall be faxed within 24 hours to the Transportation Laboratory at the number below.

The above information and samples are to be sent to: Transportation Laboratory, Chemical Testing Branch, 5900 Folsom Blvd., Sacramento, CA 95819-0128, attn.: Lisa Dobeck, Fax (916) 227-7168.

#### 5.0 PREPARATION FOR DELIVERY

5.1 Packaging: All manufactured paint shall be prepared at the factory ready for application. The finished paint shall be furnished in the container size specified in the purchase order or contract.

When 19 liter containers are specified, they shall be round and have standard full open head and bail. If 208 liter steel drums are specified, they must have removable lids and airtight band fasteners.

When bulk containers are required by the purchase order or contract, the paint shall be delivered in a container (tote) meeting the following requirements.

1. Tank volumes are estimated and so specified in each of three (3) Bulk Container drawings dated 09-04-91. Vendor shall allow a 19 liter headspace for expansion of the paint.
2. Maximum size in regards to width, depth and height shall be in accordance with one of the three drawings dated 09-04-91.
3. Top openings; 46 cm diameter manhole and 15 cm diameter fill cap.
4. Bottom outlet; 5 cm I.D. full flow non-restrictive valve with outlet guard.
5. Outlet to have 'Ever-Tite' or compatible quick coupler.
6. Fabricated from 304 stainless steel.
7. Capable of being stacked two (2) high when full.
8. Capable of being lifted by crane (lifting eye) and forklift when full.
9. Top of tank shall be equipped with one (1) vacuum relief valve and one (1) pressure relief valve.
10. Top opening and outlet shall provide for easy installation of liner.
11. Proper certification by the California Highway Patrol that the container complies with all applicable laws, rules, and regulations.

All shipping containers must comply with Code of Federal Regulations, Title 49 and all other applicable Federal and State Regulations governing their use. The containers and lids must lined with a suitable coating so as to prevent attack by the paint or by agents in the airspace above the paint. The lining must not come off the container or lid as skins.

Containers shall be colored white, including lids, and have an identifying band of the appropriate color around and within the top one-third of the container. Stainless steel containers (totes) do not need to be painted white.

All containers shall be properly sealed with suitable gaskets and shall show no evidence of leakage and shall remain in satisfactory condition for a period of 12 months after delivery. The vendor shall be held responsible for replacing containers unfit for use and will be responsible for all costs and transportation charges incurred in replacing paint and containers.

All containers shall be palletized and banded for shipment.

5.2 Marking: All containers of paint shall be labeled showing the State Specification number (8010-20B), manufacturer's name, date of manufacture, color and manufacturer's batch number. Containers shall be clearly labeled "Waterborne Traffic Paint".

All containers of the paint shall be labeled to indicate that the contents fully comply with all rules and regulations concerning air pollution control in the State of California.

The manufacturer of the paint shall be responsible for proper shipping labels with reference to whether the contents are; toxic, corrosive, flammable, etc., as outlined in the Code of Federal Regulations, Title 49.

The Contractor shall list on the Demountable Weight Tags the kilograms per liter and pounds per gallon each for the white, yellow and black paints.

## 6.0 NOTES

- 6.1 Certification of Compliance: The manufacturer shall furnish a Certificate of Compliance with each batch of paint, in accordance with the provisions of Section 6-1.07 of the Department of Transportation Standard Specifications, July, 1999.

## 7.0 QUALIFIED PRODUCTS LIST (QPL)

- 7.1 All paint samples submitted will be inspected for compliance with this specification. Paint complying to this specification will be listed on the State of California Qualified Products List for: Paint, Waterborne Traffic Line, White, Yellow and Black. The manufacturer shall maintain sufficient quality control over his paint production to ensure that subsequent batches of his product comply with this specification and are the same as sample(s) originally evaluated and qualified under this specification. When changes in manufacture are made to products appearing on the Qualified Products List, it is the responsibility of the supplier to immediately notify the Department of Transportation of such changes. Deliveries of the new product shall not be made until the product has been submitted to the Department of Transportation, evaluated and qualified.

- 7.2 Qualification testing and evaluation shall be performed by the Transportation Laboratory. A minimum of 15 liters each of white and yellow paints, and 4 liters of black paint will be required for laboratory and field testing of the paints. The vendor will be responsible for applying the paints to a roadway test area at a time and place designated by the Transportation Laboratory. All shipping charges for the paint shall be prepaid by the vendor. Vendors seeking qualification must send the above quantity of paint and the following information to the Transportation Laboratory, Chemical Testing Branch, 5900 Folsom Blvd., CA 95819-0128.

- Material Safety Data Sheets.
- Product numbers and batch numbers of the submitted samples.
- Test results, from a qualified testing laboratory, of the batches of paint submitted for qualification showing the following data: Dry to No Pick-Up time, Dry Opacity, Yellow Color, Yellowness Index, Reflectance, Consistency, Non-Volatile Weight Percent, Pigment Weight Percent and Density.

(NOTE: A qualified testing laboratory shall have trained personnel and all the proper laboratory equipment necessary, on-site, to perform the following routine quality control tests according to the methods specified herein: Dry to No Pick-Up time, Dry Opacity, Yellow Color, Yellowness Index, Reflectance, Consistency, Non-Volatile Weight Percent, Pigment Weight Percent and Density).

Paint submitted shall meet all the requirements of this specification. Vendors must qualify for white, yellow and black paints, no partial qualification will be allowed. The following pages contain a list of traffic paint products meeting this specification.

California Dept. of Transportation  
Specification #8010-20B (revised Jan., 2000)  
File: Spec8010-20B2.DOC  
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**STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION**

**QUALIFIED PRODUCTS LIST (QPL) FOR <sup>3</sup>SPECIFICATION #8010-20B**

**Paint, Waterborne Traffic Line, White, Yellow and Black**

**(revised Jan. 2000)**

Manufacturer	Manufacturer's Product Code	Color
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Pervo Paint Company	6000	White
	4051-0017	White
	4051-0019	White
	6003	Yellow
	4054-0020	Yellow
	6002	Black
	6052	Black
	4053-0025	Black
	4053-0026	Black
TMT-Pathway, LLC	28-48-1	White
	28-52-2	Yellow
	2677A7	Black
Ennis Paint Company	EP-CA-301	White
	CAW-21-M-1	White
	CAW-21-M-2	White
	EP-CA-302	Yellow
	CAY-21-M-1	Yellow
	CAY-21-M-2	Yellow
	EP-CA-303	Black
	CABK-21-M-2	Black
Centerline Industries, Inc.	LRM99-144CLI	White
	LRM99-145CLI	Yellow
	LRM99-147CLI	Yellow
	LRM99-148CLI	Black
	LRM99-149CLI	Black

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Manufacturer	Manufacturer's Product Code	Color
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Linear Dynamics, Inc.	99-152LDI	White
	99-155LDI	Yellow
	99-156LDI	Black
	99-157LDI	Black
Sherwin Williams Highway Products	BP-16448	White
	BP-16449	White
	BP-16450	Yellow
	BP-16451	Yellow
	BP-16452	Black
	BP-16453	Black